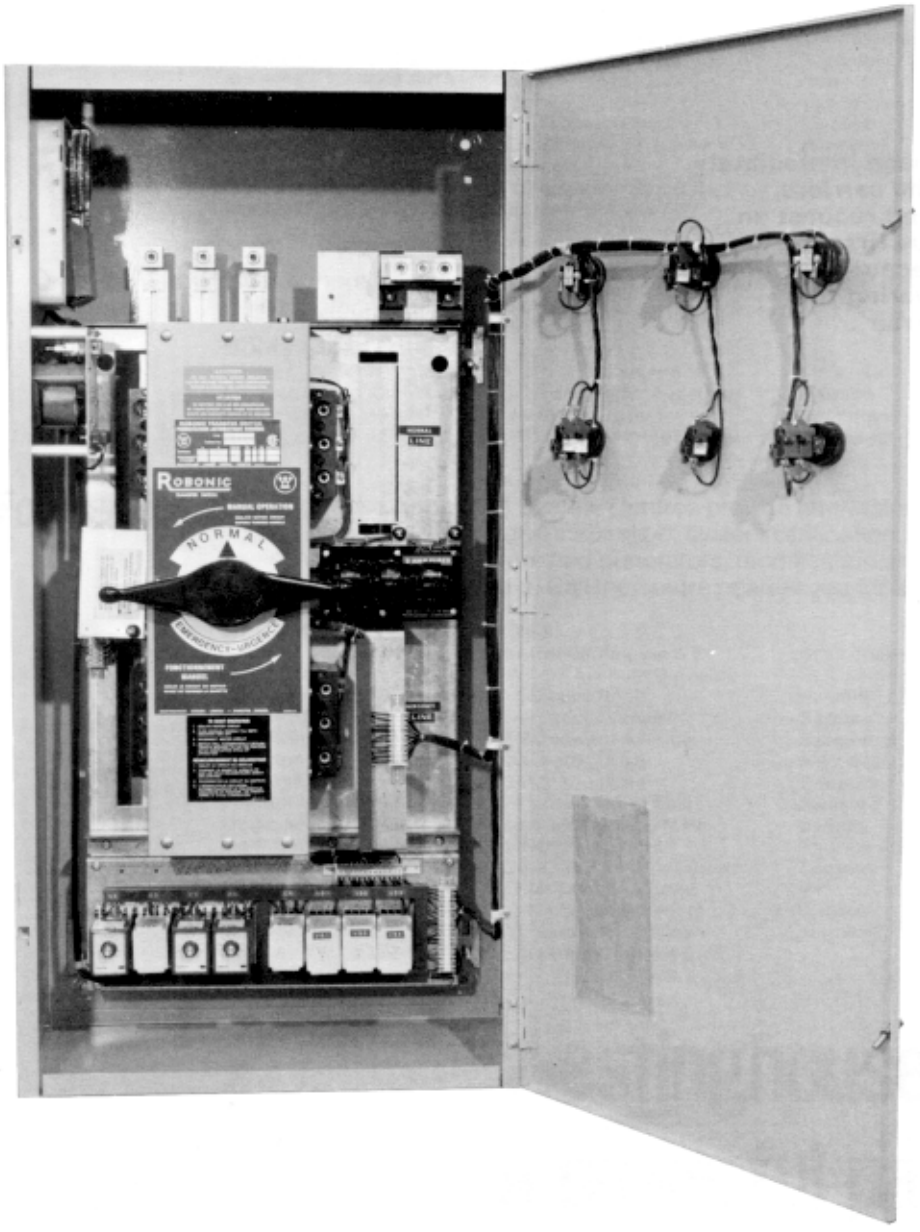
October, 1979
Supersedes issue dated October, 1975
Instruction Leaflet 30-470 (E) Pages 1-12

ROBONIC

Automatic Transfer Switches



Index

Warranty 2
Westinghouse Offices 3
General Description 4
Component Identification 5
LRO Description 5
RO Description 6
PRO Description 6
Application Information 7
Automatic Control 7
Replacing Parts 11
Trouble Shooting Guide 12
Recommended Maintenance 12

Operation and Maintenance Manual

Warranty

The Company warrants the apparatus to be supplied hereunder to be of the kind designated or specified. The Company shall repair or replace any defective part or parts, f.o.b. the Company's factory, repair shop or warehouse, which prove to be defective under normal and proper use within one year from the date of shipment, provided that the Purchaser gives the Company immediate written notice of any such defect or defects. In no event (including, but not limited to the negligence of the Company, its employees or agents) shall the Company be liable for special or consequential damages or damages for loss of use and on expiration of the Warranty period, any liability of the Company shall terminate. This constitutes the only warranty of the Company and no other warranty or condition, statutory or otherwise, shall be implied.

Important

'Check equipment for shipping damage immediately on receipt. In case of fire damage call the carriers concerned at once for inspection, and request an inspection report. Do not write to us first — notify the carrier instead. If this precaution is not taken we cannot assist you in recovering the amount of the claim against the carrier'.

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WESCO Sales Offices

Abbotsford	859-3111	34446 South Fraser Way	Red Deer	343-2113	1-7743 50th Avenue
Calgary	253-7561	810-59th Avenue S.E.	Regina	525-5841	1625-8th Avenue
Calgary	253-7561	1316-11th Avenue S.W.	Rimouski	724-9224	46, rue St-Germain est
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Hamilton	528-8811	1910 Barton Street East	Thunder Bay	622-0638	700 Norah Crescent
Kamloops	374-2112	705 Notre Dame Drive	Toronto	445-0550	840 York Mills Rd. Don Mills
Kelowna	860-3918	1936 Kent Road	Trail	368-6474	860 Eldorado Street
Kitchener	893-6630	10 Goodrich Drive	Vancouver	682-5533	1000 Beach Avenue
Moncton	854-8600	400 Edinburgh Drive	Victoria	382-7265	481 Cecelia Road
Montreal	631-9471	2125, 23e avenue Lachine	Windsor	966-2300	59 Eugenie Street East
Ottawa	733-2500	1800 Bank Street	Winnipeg	772-9401	1460 Ellice Avenue
Prince George	562-3306	2223 Nicholson Street N.			
Quebec	656-1025	2385, rue Watt Ste-Foy			

Westinghouse products for electrical utilities are available through the listed Utility Sales offices. Call the office nearest you.

Utility Sales Offices

Calgary	265-1204	807-324 8th Avenue S.W.	Montreal	812-2566	2723-1, Complexe Dejardins
Edmonton	428-7540	303-10506 Jasper Avenue	Toronto	595-9551	1012-790 Bay Street
Fredericton	454-6952	460-440 King Street	Vancouver	689-4243	2699 Harbour Centre
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For Service

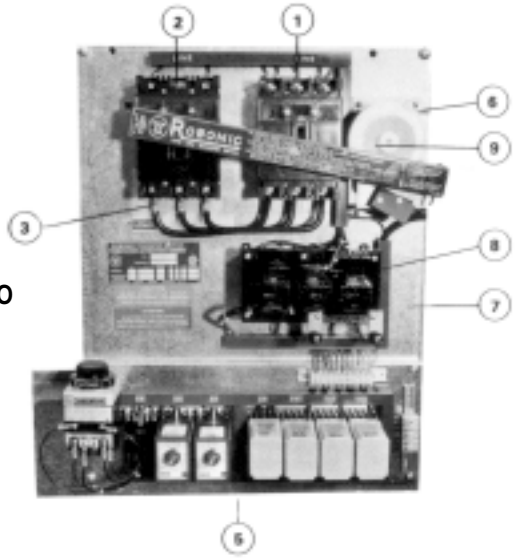
Westinghouse Apparatus Service Centres provide after-sales service, installation and start-up supervision, also testing and inspection, systems verification, field repairs, alignment and balancing, rewind of all types of motors and generators, modification and rebuilding for all makes of electrical and mechanical equipment. Call the centre nearest you for service at all hours.

Apparatus Service Centres

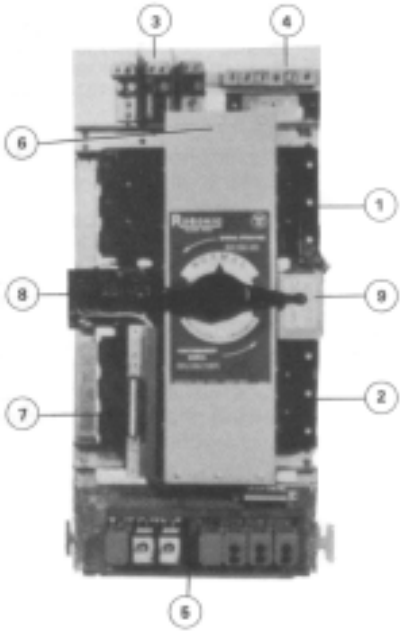
Calgary	273-0991	1857 Centre Avenue S.E.	St. Catharines	682-8336	234 Welland Avenue
Dartmouth	469-8400	71 Wright Avenue Burnside	St. Catherines	688-2263	5 Seapark Dr.(Marine Serv)
Edmonton	465-7541	8011 Davies Road	St. John's	722-7282	89 O'Leary Avenue
Fort McMurray	743-8123	8204 Fraser Avenue	Sarnia	337-3285	348 Queen Street South
Hamilton	545-1151	717 Woodward Avenue	Saskatoon	653-4313	800-47th Street East
Kingston	389-8565	639B Justus Drive	Sept-Iles	962-9803	180, rue Maltais
Kitchener	893-7420	350 Manitou Drive	Sudbury	522-3210	1360 Kelly Lake Road
London	453-0470	1921 Huron Street East	Swastika	642-3252	Westinghouse Avenue
Medicine Hat	526-0759	1248 Brier Parkway N.W.	Sydney	562-2242	RR2 Marion Bridge
Moncton	382-4457	80 Entreprise Street	Thunder Bay	577-4267	635 Mountain Avenue
Montreal	748-8811	180, rue Authier St-Laurent	Toronto	255-8551	55 Goldthorne Ave.
Nanaimo	758-9171	2311 McCullough Road	Vancouver	278-9841	1330 Vulcan Way
Prince George	562-5571	2235 Nicholson Street N.	Windsor	944-0121	4080 E.C. Row Unit 22, RR1
Quebec	656-1026	2385, rue Watt, Ste-Foy	Winnipeg	775-8643	1460 Ellice Avenue
Regina	352-5606	545 Dewdney Avenue East			

Mechanical Component Identification

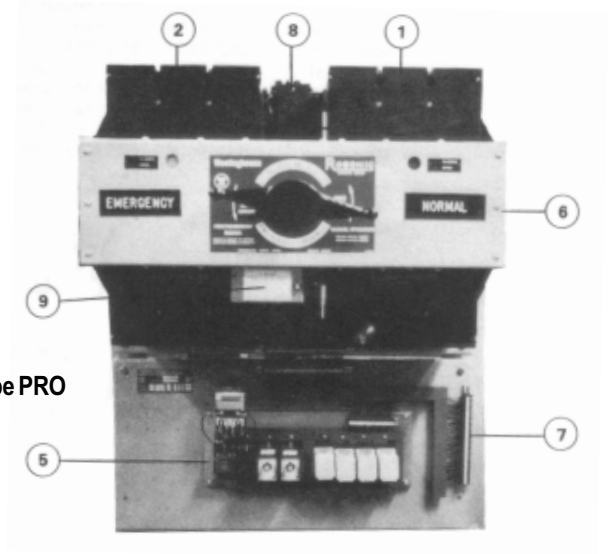
Type LRO



Type RO



Type PRO



General Description

CSA Standard C22.2 No. 178-1978 defines an automatic transfer switch as, “self acting equipment for transferring one or more load conductor connections from one power source to another.”

“Transfer” switch type A means an automatic transfer switch that does not employ integral overcurrent devices”. ‘Transfer switch, type B means an automatic switch that (does) employ integral overcurrent protection”. Westinghouse Robonic automatic transfer switches are available in both types. Robonics in type A are equipped with special instantaneous magnetic only breakers. The trip settings of these special breakers are set (and fixed) at higher than standard values so that they will trip only if the upstream circuit protective device trips. Incorporating these special magnetic only breakers, a type A Robonic operates in exactly the same way as a transfer switch not having this feature. In the event that both devices trip, (the upstream protective device and the magnetic only breaker in the Robonic) the Robonics control circuitry will automatically initiate transfer to the alternate source. The transfer operation will reset the “tripped” magnetic only breaker.

Information on interrupting, closing and withstand ratings, and recommendations for maximum upstream protective devices for type A Robonics, are given in tables 1, 2 and 3, on page 7.

Type B ‘Robonics’ are equipped with standard thermal-magnetic breakers which will provide the required overload and short circuit protection. Type B Robonics can also be built using Seltronic or SCB breakers which could include ground fault tripping as well as overload and short circuit. For application information or assistance with type B Robonics, refer to Westinghouse.

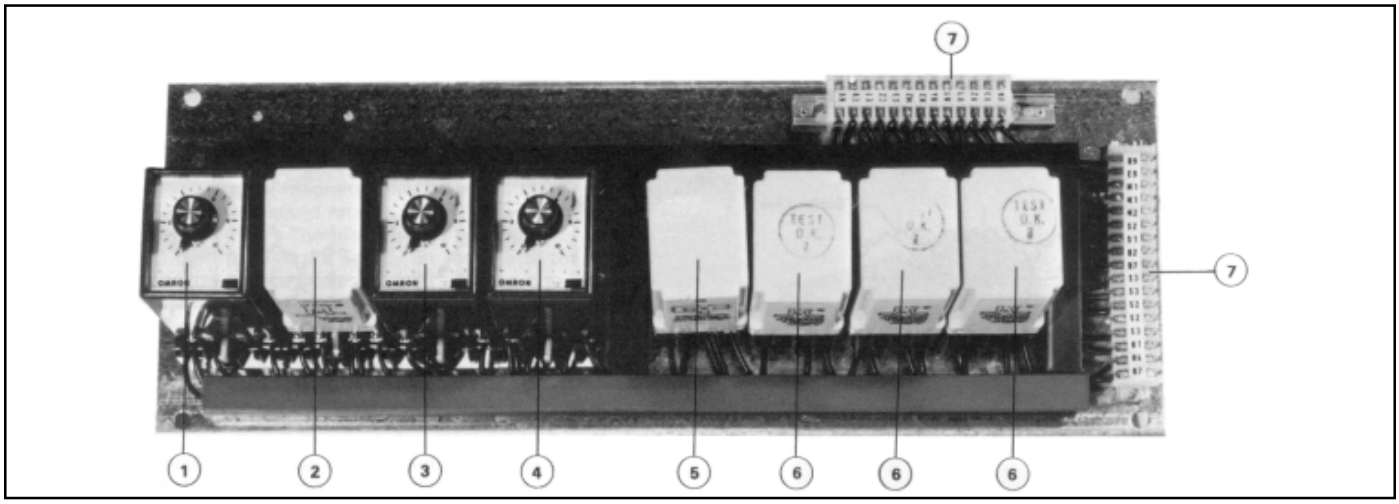
The Robonic provides automatic transfer of an electrical load to a standby power supply in the event of drop or loss of voltage of any or all phases of the normal power supply. Upon the restoration of the normal supply, the electrical load is automatically retransferred to the normal power supply.

The transfer motor utilizes the power from the source to which the electrical load is being transferred. The mechanism provides a positive mechanical interlock to prevent both breakers being closed at the same time. The mechanism is also designed to leave both breakers trip free in the closed position, permitting incorporation of thermal and short-circuit protection in either or both breakers. In the higher ampacity models, type RO and PRO, an alarm switch contact is supplied. This contact is connected in the transfer motor circuit to lock the motor circuit out of operation when the breaker(s) trip on an overload or short-circuit condition. Then the breaker has to be manually reset. Instructions for the reset procedure are located on the front of the operating mechanism.

Most of the control components are plug-in units which are easily replaced.

1. **Normal Source Connections**
2. **Emergency Source Connection**
3. **Load Connections**
4. **Neutral Connections**
5. **Control Panel**
6. **Transfer Mechanism**
7. **Customer Connections**
8. **Control & Sensing Transformers**
9. **Transfer Motor**

Automated Control Component Identification



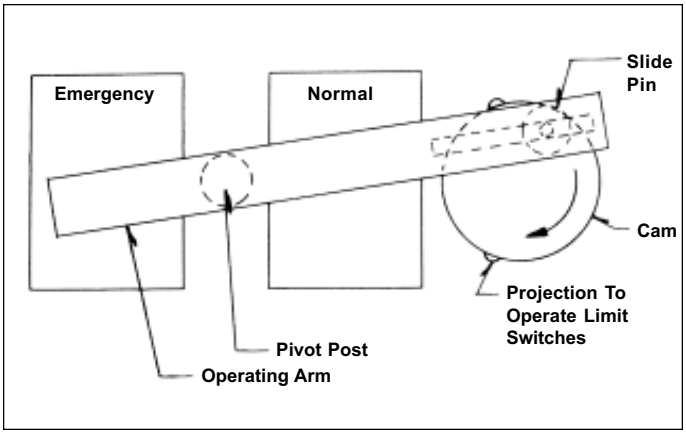
1. NE — ON Delay Relay — Assuring emergency source will remain
2. ES — OFF Delay Relay — Overriding momentary dips or outages
3. EC — ON Delay Relay — Running standby unloaded to cool
4. EN — ON Delay Relay — Assuring normal source will remain
5. CR — Control relay — Voltage and frequency sensitive
6. VS — Voltage sensing relays — Sensing normal source
7. Terminal block connection

Type LRO Robonic Automatic Transfer Switch

Rated 30 amperes through 100 amperes at 600 volts Ac maximum 50 or 60 Hertz.

The mechanism is a lever operated device controlled by a 120 volt unidirectional motor.

The transfer motor drives a nylon cam which in turn operates a steel lever by sliding a pin along a slot in the back of the lever. The lever, in turn, operates the two breaker handles. The distance travelled is determined by two projections on the cam. These projections operate two micro switches (NLS, ELS) which in turn disconnect the power to the transfer motor causing a brake to operate.



The type LRO has three operating positions. They are the normal breaker closed and the emergency breaker open, the emergency breaker closed and the normal breaker open or both the normal and emergency breakers open but never both normal and emergency breakers closed.

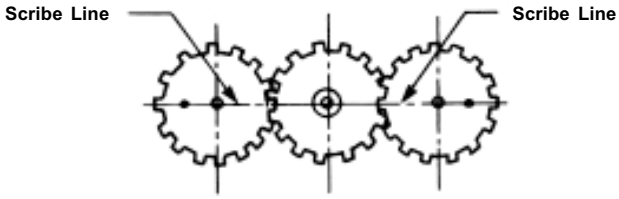
The type LRO can also be easily manually operated. Open the lever cover, remove the slide pin and place it in the hole supplied in the lever cover and close the cover. Then the lever can be manually operated for what ever position desired without interference by the automatic control. For automatic control again, simply align the lever slot with the hole in the operating cam and replace the slide pin.

The various automatic control components are described under the section titled “Automatic Control”.

Type "RO" Robonic Automatic Transfer Switch

A complete line rated from 150 amperes through 1000 amperes at 600 volts Ac or at 250 volts Dc.

The transfer mechanism consists of the transfer motor, a gear train and two breaker operating cams.



Spur Gear Meshing Relationship
(bottom view of top cover)

The transfer motor drives the centre gear which in turn operates the two secondary gears. There is a projection in the secondary gears which slides in a groove in the operating cams moving the cams from side to side. The breaker handles are set inside two outer guides of the cam and are also moved from side to side. There are two micro switches (NLS, ELS) inside the breakers which are operated by the breaker's main contacts to disconnect the transfer motor power supply and allow the brake to operate.

The type "RO" transfer switch has three operating positions, the normal breaker closed and the emergency breaker open, the emergency breaker closed and the normal breaker open or both the normal and the emergency breakers open but never both the normal and emergency breakers closed at the same time.

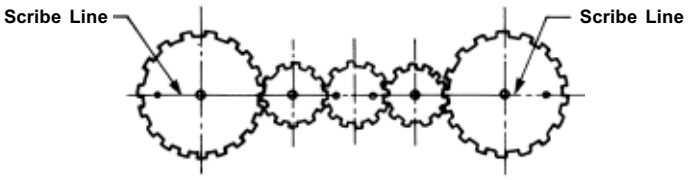
The type "RO" Robonic Transfer Switch is also easy to operate manually. Simply remove the transfer motor link and turn the black handle on the front of the transfer mechanism in a counter clockwise direction until you hear the breakers operated and the indicator is in the desired position. There will be no interference from the automatic control. For automatic control again, replace the transfer motor link and the Robonic transfer switch will seek the power available.

The various control components are described under the section titled "Automatic Control".

Type "PRO" Robonic Automatic Transfer Switch

Rated 1200 amperes through 3000 amperes at 600 volts Ac or 250 volts Dc.

The transfer mechanism consists of a transfer motor, a gear train and two breaker operating cams.



Spur Gear Meshing Relationship
(bottom view of top cover)

The transfer motor drives a centre gear which in turn drives two inner secondary gears. These two inner gears then drive larger, outer secondary gears. There are projections from these outer secondary gears which slide in a groove at the back of each operating cams moving the cam up and down. The breaker handles are set inside two outer guides on the cams, moving up and down with the cams. There are two micro switches (NLS, ELS) inside the breakers which are operated by the breaker's main contacts to disconnect the transfer motor power supply and allow the brake to operate.

The type "PRO" transfer switch has three operating positions, the normal breaker closed and the emergency breaker open, the emergency breaker closed and the normal breaker open or both the normal and emergency breakers closed at the same time.

The type "PRO" Robonic Automatic Transfer Switch is also easy to operate manually. Simply remove the transfer motor link and turn the black handle on the front of the transfer mechanism in a counterclockwise direction until you hear the breakers operated and the colour indicator shows the desired position. For automatic control again, replace the transfer motor link and the Robonic Transfer switch will seek the power available.

The various control components are described under the section titled "Automatic Control".

Table 1 — Interrupting, Closing and Withstand Rating — Robonic Type A

Robonic Continuous Rating	rms symmetrical amperes		
	600 Vac	480 Vac	120,208,240 Vac
30 to 100 amps	14,000	14,000	18,000
150 to 1000 amps	22,000	30,000	42,000
1200 to 3000 amps	100,000	100,000	125,000

Since type A Robonics employ magnetic only breakers, their interrupting, closing, and withstand ratings are the same value. Under fault conditions, with it's "normal" breaker closed, a Robonic is required to withstand the energy let through of the normal service protective device while the fault is being cleared. At the same time, should the normal voltage fall below the voltage sensing relay's selected value, – and if the alternate source were available, the Robonic could transfer before the normal service protective device cleared the fault.

This would require that the Robonic be capable of interrupting the protective device's let through current. In addition, the Robonic could be required to close in on a fault. Thus can be seen the need for Robonics to have, interrupting, closing and withstand ratings.

The interrupting, closing and withstand ratings shown in Table 1 are those for standard type A Robonics. For higher values, consideration can be given to use of Robonics built with Mark 75, Tri-Pac or SCB breakers.

Table 2 — Maximum Upstream Circuit Protective Devices for Type A Robonics, All Classes of Loads

Standard Robonic Continuous Rating (amperes)	Maximum Upstream Breaker Frame Size	Maximum Upstream Fuse Rating	
		Class J or L	Class K5 or R
30, 70, 100	EHB, FB, FB-P	100	100
150, 225	CA, JA, KA	225	225
400	DA, LB, LA-P	400	400
600	LA600	600	600
800	MA, MC, NB-P	800	800
1000, 1200	NB, NC	1200	....
1400, 2000	PB, PB-P, PCC	2000	....

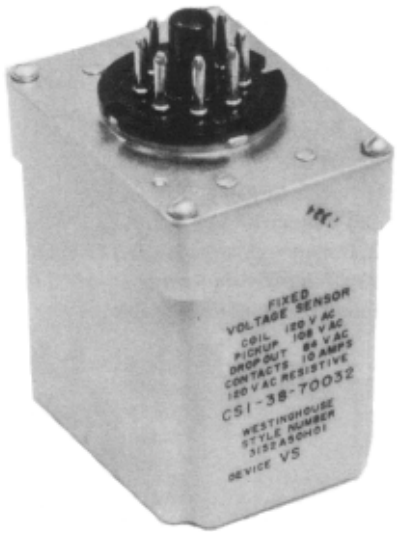
Table 3 — Maximum Upstream Circuit Protective Device for Type A Robonics, 90% or Larger Motor Load

Standard Robonic Continuous Rating (amperes)	Maximum Upstream Breaker Frame Size	Maximum Upstream Fuse Rating	
		Class J or L	Class K5 or R
30, 70, 100	EHB,FB,HFB,FB-P LA-P,c/w 400 LAP10	300	100
150, 225	CA,JA,KA,HKA,LA HLA,LB,HLB,MA,NB LA-P,NB-P c/w 1000 NB14 MC,NC	400	225
400	LA,HCA,LA-P,LB,MA HMA,NB,HNB,NB-P MC,HMC,NC,HNC	600	400
600	MA,HMA,MC,HMC NB,NC,HNC,NB-P	1200	600
800	MA,HMA,NB,HNB, NB-P MC,HMC,NC,HNC	1200	....
1000	NB,HNB,NC,HNC,PB-P	1200	....
1200	NB,HNB,NC,HNC,PB-P	1200	....
1400, 2000	PB,PB-P,PC	2000	....

Automatic Control

Voltage Sensing Relays

Ratings — 1.0 volt-ampere power consumption
Input Coil Voltage — 120 volts at 50/60 hertz
Contact Rating — 3.0 amperes resistive at 120 volts
Duty — continuous
Operating Temperature Ratings — -10°C to +55°C



Description

The device VS is an octual plug-in unit complete with solid-state sensing and a DPDT relay enclosed in a dust-tight, yellow capsule. The receptacles and plugs are designed to ensure a tight fit to reduce the possibility of coming loose through vibrations.

The solid state sensing of the fixed model has been factory set for pickup and dropout values of 104 volts Ac and 84 volts Ac respectively. The adjustable model voltage sensor has a variable range of pickup, 92 volts to 140 volts Ac and dropout, 90 volts to 138 volts Ac with a close differential of 2 volts.

The contacts being two pole double throw allows one set to be incorporated in the control scheme and an additional set for external connections if required.

Application

When used on the Robonic Automatic Transfer Switch as an under-voltage sensing device, they have been designated as devices VS. The standard Robonic Transfer Switch comes with one fixed voltage sensor, VS1, for single phase application and three fixed voltage sensors, VS1, VS2 and VS3, for three phase applications, all of which monitor the normal power source only.

The single phase voltage sensor is connected to the normal control transformer, NT, to monitor the normal source.

The three phase voltage sensors are connected to three smaller transformers, VST, which are connected in a delta-Wye configuration for use on all voltages, including 120/208 volts, none of which use the system neutral.

Automatic Control (Continued)

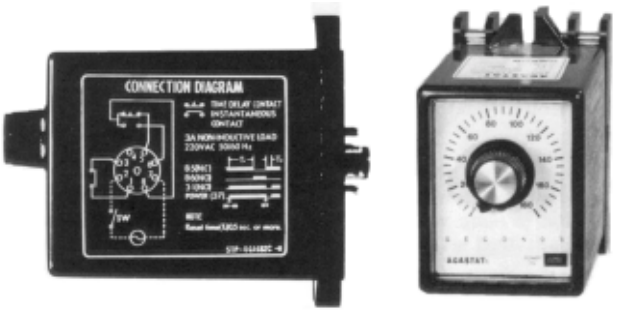
When adjustable type voltage sensors have been ordered, they are factory set to dropout at 90 volts and pickup at 108 volts Ac. For adjustment to other settings, first set the drop value and adjust the pickup to desired setting. This is done by using a variable power supply for the coil, pins 2 and 7, and using an ohm meter on the contacts to determine when the relay has picked-up.

Additional relays are available for over voltage monitoring, emergency source monitoring, and 125 volt Dc applications.

Note: The pickup and dropout settings do vary with temperature variations at a rate of 0.1% per degree C from a nominal operating temperature of 25°C.

"On Delay" Time Delay Relays

Ratings — 6 Watts Power Consumption
Input coil Voltage — 120 Volts
Contact Rating — 3 amperes at 220 volts Ac 50/60 Hertz
Operating Temperature Rating — -10°C to +50°C
Time Ratings — Various available



Description

This time delay relay is an octual plug-in, synchronous motor type. It is complete with clutch and mechanical load switch giving one instantaneously operated normally open contact and a timed single pole double throw contact in a dust-tight grey capsule. The mechanism is constructed to operate for the time set on the indicating dial and then disconnect itself when the timing cycle is complete. A red pilot light on the face plate indicates that the relay is timing to operate its contacts. When de-energized, the relay requires a reset time of at least 0.5 seconds. Time delay begins immediately upon energizing the coil.

When the timing cycle is complete, a mechanical latch holds the contacts in position and the coil is de-energized.

Application

The time delay relay is used on the Robonic Automatic Transfer Switch for four functions. They are designated as EN, NE, EC and DT. It may also be used for additional timing functions if required.

When used as an EN device, it is incorporated into the control scheme to delay the operation of the transfer switch to the normal position, and prevent the transfer on momentary return of the normal power source. Upon restoration of the normal source it begins timing and should the source fail again prior to completing the timing cycle, the relay will reset to time again. If the normal power source should remain restored longer than the timing cycle the EN will open its normally closed contact in the control relay, CR, initiating re-transfer.

When used as an NE device, it is incorporated into the control scheme to delay the transfer to the emergency position until the normal source has failed longer than the time setting. This allows the standby source time to stabilize prior to transfer. When the time cycle is complete, it closes its contact in the control relay, CR, initiating transfer.

When used as an EC device, it is incorporated in the control scheme to delay the stopping of the standby source after re-transfer. The standby will run unloaded to cool off for the set timing cycle. When the cycle is complete, it closes its contact in the engine start relay, ES, which in turn stops the standby unit. If the normal power should fail again prior to completing the timing cycle, the transfer switch will transfer again instantly.

When used as a DT device, it is incorporated in the control scheme to stop the transfer switch with both breakers open. This is to allow residual load voltage to decay prior to closing on another supply which could be out of phase. When the timing cycle is complete, the relay re-initiates transfer to the available source.

"OFF" Delay Time Delay Relays

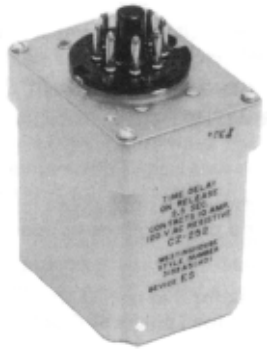
Pneumatic Type
Ratings — 8 Watts Power Consumption
Input Coil Voltage — 120 volts 50/60 Hertz
Contact Rating — 10 amperes resistive at 120 volts Ac
Time Ranges — Various available
Operating Temperature Range — -30℉C to +75°C

Description

This is a panel mount relay containing a coil, an adjustable sealed pneumatic timing head and snap action switch assembly. The relay will pick up instantaneously when the voltage is applied to the coil and it will remain in this position as long as the coil is energized. Time delay begins immediately upon de-energization and at the end of the timing cycle, the switch returns to its de-energized position. Reenergizing the coil during the timing cycle will reset the relay to time a complete cycle again.

Solid State Type

Ratings — 1.2 watts power consumption
Input Coil Voltage — 120 volts at 50/60 Hertz
Contact Rating — 10 amperes resistive at 120 volts
Time Range — 2 to 3 seconds — nonadjustable
Operating Temperature Range — -10°C to +55°C



Description

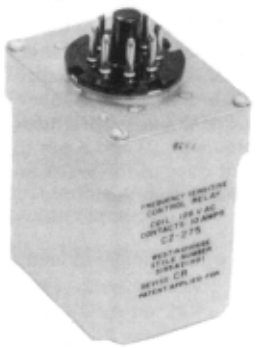
This is an octal plug-in relay containing solid-state control, a Dc coil and a one pole single throw set of contacts complete in a dust-tight yellow capsule. The relay will pick up instantaneously when voltage is applied to the coil and remains in this position as long as the coil is energized. Timing begins immediately upon de-energization and at the end of the timing cycle, the contacts will return to their original position. If the power should return prior to the completion of the timing cycle, the relay will reset for another complete timing cycle.

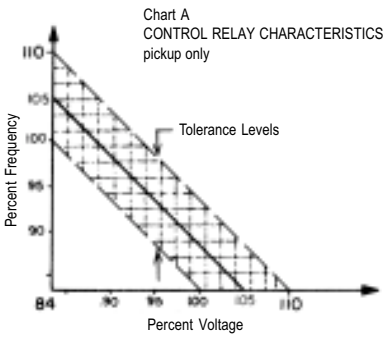
Application

When used on the Robonic Automatic Transfer Switch as an engine starting relay, this relay has been designated as a device E.S. The relay is incorporated in the control scheme to delay the start-up of the engine-generator set until normal supply voltage has been interrupted for a longer time than the timing period. If normal supply voltage has not returned by the end of the delay period, the relay contacts cause the engine-generator set to start and when the emergency supply voltage and frequency has reached the pickup value of the control relay, the relay will energize and initiate the operation of the transfer switch to the emergency position.

Control Relay (CR)

Ratings — 1.2 volt amperes power consumption
Input Coil Voltage — 120 volts 60 hertz and 50 hertz
Contact Rating — 10 amperes resistive
Operating Temperatures — -10°C to +55°C
Settings — 50 hertz fixed sensing or 60 hertz fixed sensing





Description

This device CR is an octal plug-in unit complete with solid-state sensing, single pole, double throw set of contacts, two sets of single pole single throw contacts and a Dc coil enclosed in a dust-tight yellow capsule. The receptacles and plugs are designed to ensure a tight fit to reduce the possibility of coming loose through vibrations.

The solid-state sensing of both the 50 and 60 hertz relays is set for pickup values as indicated on the above chart.

Application

The control relay, CR, is incorporated into the control scheme to prevent the transfer of the load to the standby power source until the source has reached an acceptable level of voltage and frequency. In doing so, there will be little chance of damage due to low voltages or low frequencies. If the standby power source can only produce voltage an insufficient frequency or frequency and insufficient voltage the Robonic Automatic Transfer Switch will not transfer to the standby power.

When the standby power source is supplying sufficient voltage and frequency, this relay will operate its contacts and initiate transfer. Upon restoration of the normal supply, device EN will open its contact in the control relay circuit causing the relay to de-energize initiating operation of the transfer switch to the normal position.

Plant Exerciser (as used in Robonic Transfer Switches)

Ratings — Input voltage 120 volts
Contact rating 20 amps at 120 volts resistive S.P.D.T.

Description

Dial A is divided into a 24 hour day and night scale, and has tabs around the periphery which may be adjusted to operate the micro switch within intervals each 24 hours. Each tab represents a 15 minute interval. Dial B has 7 spokes and advances one position for each revolution of Dial A. Each spoke has provision to add a pin to operate the micro switch. These pins represent days of the week and their function is to prevent operation of the micro switches on selected days.

The micro switch has one normally open and one normally closed contact.

Application in Robonic Transfer Switches

The Plant Exerciser is a Program Time Switch which functions to start and stop the engine-generator set and transfer switch automatically at pre-selected intervals or times. It consists of a synchronous electric motor and a gear assembly to rotate a dial 360° each day for a week (168 hours). On the periphery of the dial there are levers or tabs which can be set to operate a mechanical load switch as the dial rotates. These levers can be selected to operate the switch at specific times of the day daily or specific days of the week. The cycle repeats weekly. The Plant Exerciser may be used in two different ways as an accessory for transfer switches.

1. It may be used to simulate an interruption in the normal source of supply at selected intervals, at least once per week, causing the transfer switch components to function, including start-up of the engine-generator set and transfer of load to the generator supply. At the end of the interval it will initiate the transfer back to normal supply and shut down the engine-generator.

or

2. It may be used to start an engine-generator set at selected intervals, at least once per week, but without causing the transfer switch to operate and transfer the load to the generator supply. At the end of the interval it will cause the engine-generator to shut down.

Instructions — To operate the engine for an interval once each week, with or without operation of the transfer switch.

1. Extend the tabs of Dial A outwards, except those representing the time of day for the running of the engine or operation of the transfer switch.

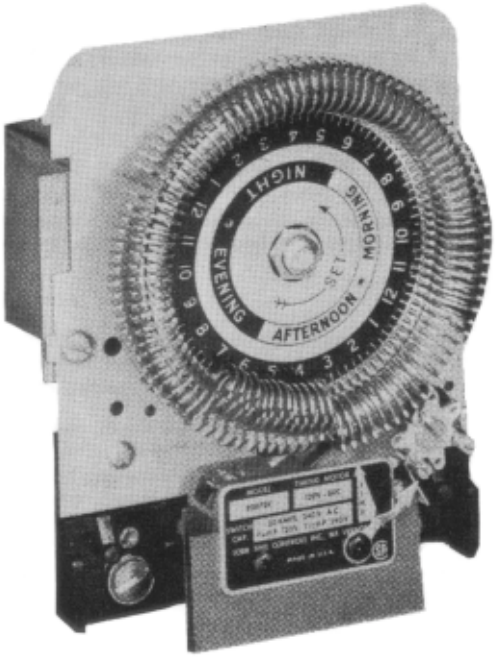
2. Determine the day of the week for this testing. Install the six brass pins (called skip pins) in the spokes of Dial B representing the other six days of the week.

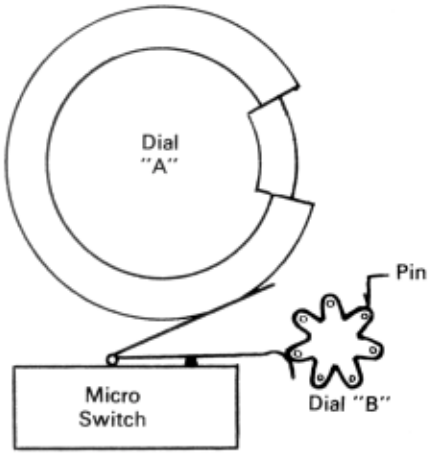
3. Turn Dial A counterclockwise until the special tab at 12:00 midnight advances Dial B. Turn Dial B until the present day of the week is opposite the copper arrow. Turn Dial A counterclockwise until the correct time of day (or night) is opposite the arrow on the name plate.

4. If the interval of running the engine is desired more than one day per week but at the same time of day, remove the skip pin from the appropriate spoke of Dial B.

Caution

DO NOT insert skip pins in any spoke when that spoke is pointing toward the copper arrow.





Replacing Parts

The Robonic Automatic Transfer Switch has been designed to have all components accessible and readily removable from the front of the panels. The Robonic Transfer Switch is divided into two basic sections. The upper section consists of the main contacts and transfer mechanism, the lower section consists of all the automatic control devices.

Caution

When replacing any parts of the mechanism, control transformers or breakers, isolate the Robonic Transfer Switch from any possible source of power.

To remove the transfer mechanism of the LRO transfer switch, first open the cover and remove the slide pin from the operating cam, then remove the centre bolt, the mechanism will lift straight off. The breakers and transfer motor bracket are held by four screws for ease of removal and replacement. When replacing the mechanism, first set it on the Robonic with the breaker handles in the holes provided and then fasten the centre bolt reasonably tight with the mechanism fully movable with an equivalent swing distance up and down.

To remove the transfer mechanism of the RO transfer switch, remove the four bolts holding it, taking note of which holes the bolts were in, then lift the mechanism straight off. The breakers are held by two bolts at one end and the bus connectors on the other end. The transfer motor is mounted to the transfer mechanism cover and centre drive gear. When replacing any part of the transfer mechanism, be sure that the scribe lines of the gears are in a straight row (example shown below).

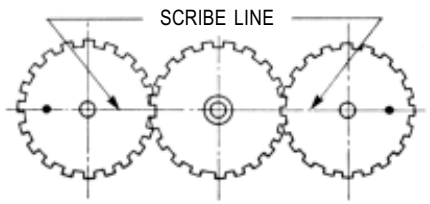
When replacing the mechanism move it about until the breaker toggles fit between the mechanism fingers and then fasten the bolts tightly. To test for proper operation first operate manually and then connect 120 volt, 60 hertz supply to motor leads and observe operation for free movement and proper breaker operation.

The PRO transfer switch mechanism is similar to the RO with the exception that the PRO mechanism has five gears and is mounted horizontally. The breakers are fastened to the panel by six bolts.

All Robonic transfer switch breakers and mechanisms have allowed some adjustments for mounting to assure proper operation without slipping or binding. Be sure all hardware is tightened sufficiently before reenergizing any transfer switch.

To replace any of the octal plug-in relays, pull old units straight out and insert the replacement unit. Some of the timing relays have white clips on the top and bottom to be released first. Due to the tight fit of the receptacle and pins, you may have to move the relay about a little to pull it out. **DO NOT INTERCHANGE ANY RELAY WITH ANY OTHERS.**

To prevent operation of the transfer switch while replacing mechanism or components, disconnect all source of power.



Parts List

Part Name	Style No.
Parts Common to all Robonics	
Control Relay	3155A21H01
Voltage Sensor Fixed	3152A50H01
Voltage Sensor Adjustable	3152A50H02
Timer On Delay 5–180 sec.	688A887H03
Timer On Delay 20 s–10 m	688A887H04
Timer On Delay 1–30 m	688A887H05
Timer Off Delay 1–300 sec.	688A886H11
Timer Off Delay 2.5 s fixed	3152A51H01
Instantaneous Relay	3152A52H01
Socket Potter & Brumfield	3152A52H02
Socket Omron	688A887H01
Plant Exerciser	688A888H01
Battery Charger 12V	1259C26G01
Battery Charger 24V	1259C26G03
4 Position s/s fixed	3151A90H01
4 Position s/s keyed	3151A90H02
Terminal Block 300V	688A133H01
125V Control Transformer 600V	573B414H01
125VA Control Transformer 480/416V	573B414H02
125VA Control Transformer 240/208V	573B414H03
Sensing Transformer 600V	573G414H04
Sensing Transformer 480V	573B414H05
Sensing Transformer 416V	573B414H06
Sensing Transformer 208V	573B414H07
For Type LRO Robonics	
Mechanism	833C222G02
Motor Assembly	833C223G01
Motor	688A732H02
Operating Cam	688A548G01
Slide Pin	688A731H01
Limit Switches	688A747H01
For Type RO Robonics	
Mechanism 150 to 400A	833C226G01
Mechanism 600 to 1000A	833C226G01
Motor	688A749H01
Solenoid	688A740H01
Brake Shoe Assembly	688A738G01
Operating Cam	572B774H01
Auxiliary & Limit Switch	688A747H01
For Type PRO Robonic	
Mechanism	688A109G01
Motor	688A749H02
Solenoid	688A740H01
Auxiliary & Limit Switch	688A747H01
300VA Control Transformer 600V/480V	554B408H04

Trouble Shooting Guide

Symptoms	Possible Causes
• refusal to re-transfer to normal source upon restoration	• a voltage sensing relay did not energize • emergency to normal time delay relay has failed • a loose control connection
• will not transfer to emergency source upon failure of normal source	• engine-generator did not start • generator not producing enough voltage at a high enough frequency (device CR is voltage and frequency sensitive) • a loose control connection • CR device has failed • normal to emergency time delay relay, if supplied, has failed • if voltage sensing relays supplied in emergency, there may be a failure of one
• transfer without a power failure in the normal source	• a voltage sensing relay has failed • emergency to normal time delay relay has failed
• no time delay when there should be	• that particular time delay relay has failed
• engine-generator starts when the normal source has not failed	• the engine start time delay relay has failed • a plant exerciser has been built into the system • a voltage sensing relay has failed
• normal source has failed and the transfer switch cycles without stopping in emergency	• the operating cam in the mechanism has either broken or come out of the breaker handle • ELS has failed to operate
• if the power is not available on the load terminals with either the normal or emergency sources available and the transfer switch will not operate	• the breaker may be complete with trip units and if there has been a fault on the system, the motor circuit has been opened by either EAS and NAS. Correct and manually reset the breakers in the transfer switch

Recommended Maintenance

1. DO NOT perform dielectric tests on the equipment with the control components in the circuit.
2. DO NOT use loctite.
3. Check lubricant in high speed bearings of the motor and the low speed bearings of the gear box. For lubrication use Dow Corning Silicon DC44 or equivalent on the high speed bearings and Aero Shell No. 6 grease or equivalent in gear box after 5000 operations.
4. Check if control components are tight in sockets.
5. Periodically inspect all terminals (load, line and control) for tightness. Retighten all bolts, nuts and accessible hardware. Clean or replace any contact surfaces which are dirty, corroded or pitted.
6. Robonics should be in clean, dry and moderately warm locations. If signs of moisture are present, dry and clean transfer switch. If there is corrosion try to clean off, if cleaning is unsuitable replace the corroded parts. Should dust and/or debris gather on the transfer switch, brush, vacuum or wipe clean. DO NOT blow dirt into breaker or terminals.
7. Test the transfer switch operation. While the Robonic is exercising, check for freedom of movement, hidden dirt or corrosion and any excessive wear on the mechanical operating parts. Clean, lubricate or replace parts where necessary.
8. Check all adjustable control components (time delay and voltage sensing relays) for correct settings.
9. If the type “RO” mechanism is removed be sure that the scribe lines on the gears are in line. When reassembling the drive mechanisms be sure that they are fastened to the correct holes in the frame and that the breaker handles are between the cam fingers (one breaker has to be on and the other off).

Type LRO Robonics

CAUTION

DO NOT overtighten the pivot screw inside the operating arm. This screw was correctly adjusted at the factory to provide low friction movement of the operating arm without excessive play.

DO NOT overtighten the set screw holding the operating cam on the motor shaft.